

Design Concepts for Cooled Ceramic Matrix Composite Turbine Vanes, Phase II

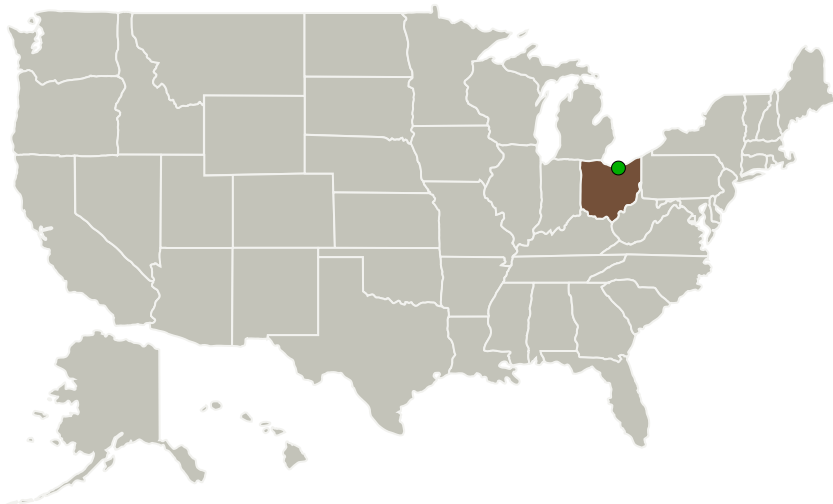
Completed Technology Project (2011 - 2013)



Project Introduction

The work proposed herein is to demonstrate that the higher temperature capabilities of Ceramic Matrix Composites (CMC) can be fully utilized to reduce emissions and improve fuel consumption in gas turbine engines. The work involves closely coupling aerothermal and structural analyses for the first stage vane of a high pressure turbine (HPT). These vanes are actively cooled, typically using film cooling. Ceramic materials have different structural and thermal properties than conventional metals used for the first stage HPT vane. Vane configurations which satisfy CMC structural strength and life constraints, while maintaining vane aerodynamic efficiency and increasing mainstream gas temperature for improved engine performance will be identified. The proposed work will examine modifications to vane internal and external configurations to achieve the desired objectives. Thermal and pressure stresses are equally important, and both will be analyzed. Three dimensional fluid and heat transfer analyses will be used to determine vane aerodynamic performance and heat load distributions.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
N&R Engineering	Lead Organization	Industry Small Disadvantaged Business (SDB)	Parma Heights, Ohio
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Ohio

Project Transitions

▶ **June 2011:** Project Start

✓ **May 2013:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138920>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

N&R Engineering

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

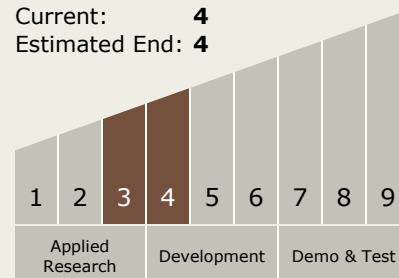
Robert J Boyle

Technology Maturity (TRL)

Start: 3

Current: 4

Estimated End: 4



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Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.3 Aero Propulsion
 - └ TX01.3.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System